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DATE 1/6/87

DOC NO GI M 86-20176

OIR 3

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25 July 1986

Syria: Increasing Use of Yarmuk River Water [redacted] 25X1

We estimate that Syria now uses approximately 200 million cubic meters (mcm) of Yarmuk River water annually and that its consumption is increasing steadily. This total includes approximately 177 mcm for irrigation and in evaporation losses from reservoirs, and 23 mcm for domestic, industrial, and animal consumption. We estimate that about one-third of the water consumed returns to the watershed's aquifers and streams as runoff. The net use of Yarmuk water by Syria is therefore now on the order of 135 mcm (4.3 cms on an annual basis), or more than one-fourth of the river's historic annual flow. This reduction of the Yarmuk's flow takes place in all months, but is probably greatest during the winter when reservoirs are filled and during the peak irrigation season in spring and summer. In future years, as Syria's new water requirements are increasingly met from stored reservoir water, a larger share of the total use will come from winter runoff. [redacted] 25X1

Our estimate of annual Syrian water usage is based primarily on analysis of the amount of land that is irrigated by Syria in the Yarmuk Basin, because Syria does not publish official statistics on actual water usage from the Yarmuk. Our conclusions are supported by a former Syrian water official who stated in 1981 that Syrian use had reached 180 mcm annually. [redacted] 25X1

Water Use

Irrigation. By the mid 1970s Syria had placed more than 100,000 dunams under irrigation in Dar'a and Al Qunaytirah Governorates. Most of the water was obtained from springs that feed Yarmuk tributaries, although in the 1970s Syria also began building reservoirs to catch surface runoff. The amount of area irrigated in any given year depended on the amount of water available during the irrigation season from the previous winter's rainfall. Double-cropping (mainly tomatoes and other vegetables in summer, and vegetables and winter wheat in the winter/spring season) was widely practiced. Even with double-cropping, however, because of water shortages the total area in crops was less than the area reported as under irrigation. For example, even during the summer season only half of the area reported as irrigated land actually produced crops (Table 1 and 2). [redacted] 25X1

GI M 86-20176

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Since the mid 1970s information on the amount of irrigated land, new reservoir construction, and well drilling indicates that there has been a significant increase in irrigation water availability and use. For example, references in the Syrian media to the amount of irrigated land associated with individual reservoir construction projects cite a total of 163,000 dunams that will be irrigated when the projects are eventually completed (Table 3). The greater availability of water from these reservoirs will allow an increasing share of this irrigated area to be cropped in both winter and summer. Based on extrapolations of official Syrian statistical reports, the total irrigated area now averages at least 145,000 dunams. Because of the widespread use of double cropping, the total area of irrigated crops is at least 150,000 dunams.

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TABLE 1

Irrigated Area in Syria's Yarmuk Basin (1000 dunams)

Irrig. Year	Irrigated Land	Actually Cropped
1973	82	NA
1974	90	NA
1975	91	81
1976	155	138
1977	124	116
1978	100	95[1]
1979	116	115
1980	119	123
1981	136	139
1982	136	143
1983	140	145[1]
1984	140	145[1]
1985	145[1]	150[1]

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[1]Estimated. All other irrigation data from Syrian statistical yearbooks.

TABLE 2

Irrigated Agriculture in Syria's Yarmuk Basin (1000 dunams)

	1975	1980	1982
Winter Crops (total)	**30,170**	**45,580**	**59,690**
Wheat & Barley	13,300	23,570	17,790
Vegetables	16,870	20,010	41,900
Summer Crops (total)	**41,170**	**64,310**	**62,340**
Maize	5,400	10,800	9,380
Tomatoes	17,530	26,780	26,930
Other Vegetables	18,240	26,730	26,030
Perennial Fruit Crops	**9,340**	**14,880**	**21,390**
Total Crop Area	80,680	122,740	143,420

We estimate that this amount of crop land requires about 167 mcm of water annually.[1] Completion of all the reservoir and irrigation canal projects now under construction will probably increase total irrigation water usage to at least 200 mcm by the year 2000.

Other Uses. We estimate that the approximately 550,000 inhabitants of Syria's Yarmuk Basin consume about 23 mcm of water annually, of which about 20 mcm is for household and industrial use and 3 mcm for livestock. Our estimate of human use is based on the assumption that per capita consumption is 100 liters per day, a typical but by no means uniform figure for parts of Syria and Jordan. Continued population growth at rates above 3 percent, industrial expansion, and improved water services could double this usage by the year 2000.

Water Supply

Of the estimated 200 mcm of water used by Syria in the Yarmuk Basin, we estimate that roughly 80 to 90 mcm is contributed by springs, 80 to 90 mcm by reservoirs, and 30 mcm by wells. Reservoirs and wells offer the greatest potential for increasing future supplies.

Springs. Syria's Yarmuk Basin contains 45 springs that produce an average of 145 mcm of water per year, or nearly a third of the Yarmuk's historic flow. Although only scattered usage data are available, we estimate that more than half--perhaps 80 to 90 mcm--of this spring water is tapped at or near its source for irrigation projects. The largest spring, at Muzayrib, produces on average 44 mcm annually and helps supply a major irrigation project. Like streamflow, spring flow depends on annual precipitation; output of the Muzayrib spring ranged from 20 mcm following the dry 1972-73 season to 50 mcm after the wetter year in 1975-76.

According to Syrian data, in the late 1970s springs supplied water to at least 78,000 dunams of irrigated land in the Yarmuk basin. This amount is increasing, although most subsequent expansion of water supplies has come from reservoirs and wells.

Reservoirs. Syria began building dams in the Yarmuk Basin in about 1970 to catch surface runoff during the winter and the perennial flow of springs feeding Yarmuk Tributaries (Table 3). The first reservoir to be completed was a 15 mcm capacity facility at Dar'a. By 1978 reservoirs in the Yarmuk Basin had a

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[1] Assumes an average crop requirement of 700 m^3 per dunam at 60 percent system efficiency, requiring 1150 m^3/yr./dunam.

combined capacity of 25 mcm and others with a capacity of 33 mcm were under construction. Most reservoirs were designed almost entirely for irrigation purposes; a few of the smaller ones in the eastern part of the basin were built for municipal uses.

At the present time, 15 Syrian dams have been completed or are under construction in the Yarmuk Basin. Together, we estimate they will have a combined capacity of about 81 mcm. We are only able to roughly estimate the amount of water that is actually diverted from the Yarmuk into the reservoirs annually because of uncertainty about how much of their capacities are normally filled and the state of operation of the irrigation systems associated with them.[1] Nevertheless, the resevoirs have clearly contributed to a significant reduction in the Yarmuk's flow, particularly since 1980. Based on their surface areas, we estimate that evaporation from existing reservoirs totals about 10 to 15 mcm annually. Total water diversion into reservoirs may thus be roughly 80 to 90 mcm annually.

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Wells. Wells supply a small but increasing share of the water used in the Yarmuk Basin, probably about 30 mcm annually. Syrian sources and observers report that Dar'a and Al Qunaytirah Governorates contain several hundred wells, including a large number of drill rigs, but do not provide their combined output. Our estimate of well output is based on Syrian statistical yearbooks that report that the amount of land irrigated from wells in Syria's Yarmuk Basin increased from 59 dunams in 1979 to 21,570 dunams in 1982. Moreover, at least part of the estimated 23 mcm domestic water use probably comes from wells.

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[1] Theoretically, the amount of water withdrawn from a reservoir could be much larger than the one-time storage capacity because filling and withdrawing could take place during the entire year.

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TABLE 3

Reservoirs in the Yarmuk Basin

Name	Capacity	Year Built	Associated Irrigated Land[1] (dunams)
Ruwayhinah	2.0	1982-84	1,300
Al Hajjah (Radimneh ?)	3.0	1980-81	1,000
Ar Rafid (Buraykeh ?)	6.0[2]	U/C	10,000
Ghadir al Bustan (Tasil)	12.0	1983	34,000
Shaykh Miskin	15.0	1982	20,000
Ibta, East	3.0	Mid-70's	
Ibta, West	1.0	Mid-70's	5,000
Adwan	6.0[2]	U/C	
Jallin (Abdeen/Shajara)	6.5	1980-83	22,000
Rum	4.6	1978	
Al Musayfirah	3.0[2]	1980-81	
Sahaweh	1.0	1980	
Dar'a	15.0	early 70's	70,000
Habran	2.0	1981	
Al Ain	1.5	1966[3]	
Total	81.6		163,000

[1] Irrigated land identified with some of these projects is also supplied from springs and wells (e.g. Muzayrib spring, with an average annual yield of 44 mcm, is probably the main water supply for the Dara project). 25X1

[2] Estimated.

[3] Being expanded from 0.6 to 1.5 mcm. 25X1

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